PATENT SPECIFICATION

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(19)

(54) METHOD OF FORMING CORNERS IN ELASTOMERIC CELLULAR STRIP

(71) We, SCHLEGEL (UK) LIMITED, a British Company, of Ring Road, Leeds, LS14 1LY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to methods of forming small radiused or acute angled corners in elastomeric cellular materials in strip form and to the resultant products of such methods.

Nowadays, strips of extruded cellular rubber are used extensively throughout the building, automotive and other trades to provide seals around doorways and the like and it is just as necessary to provide a satisfactory seal at the corner of the of the doorway as along the sides.

Typical elastomeric cellular material may be natural rubber, neoprene, EPDM rubber or other similar materials, and this may be either of solid or hollow section.

In the past, it has been customary to bend the elastomeric strip, which is normally of a soft material.

Unfortunately, however, for small radiused and acute angled corners, bending of the strip is most unsatisfactory since it is impossible for the material to conform to the corner without wrinkling occurring.

More recently, it has been the practice to mitre-cut the elastomeric strip and subsequently adhere or vulcanise the mitred faces together. This required careful control of the cutting process to give accurate cut faces, which is difficult to achieve because the inherent flexibility of the elastomeric material causes the material to deflect whilst it is being cut. Also, the inherent variation in tension across the section prevents face to face contact being achieved when the two parts of the corner are placed together. Subsequent adhering or vulcanising of the mitre is difficult because of the manual dexterity required to align the joint (manual labour is also expensive) and because of the need to stretch parts of the elastomeric material to obtain face to face contact at the joint.

One suggestion has been to injection mould vulcanisable material into the joint area and so to fill any gaps but it has been found that the pressure required to transfer the material into the joint area deforms the soft rubbery material, especially since, in many cases, it is of extruded hollow section. Also, the vulcanisable material at the joint can not normally be of cellular construction and therefore tends to have an unacceptably high load/deflection characteristic.

Furthermore, in a combination seal comprising a plastics edge finisher strip of, for exampled, PVC and an elastomeric sealing portion, the heat which must be applied to the seal to vulcanise the injected material can melt, or otherwise deform the plastics strip material.

According to the present invention, we provide a method of forming a corner in a piece or between two separate pieces of elastomeric cellular strip material including locating the material, which will eventually be adjacent to the corner, in a mould shaped to the required contours of the corner and subsequently injecting into the mould a cool-setting elastomeric material, which expands into a cellular structure, and generates heat and pressure in an amount sufficient to build up or form the corner, allowing the injected material to set and subsequently removing the finished corner from the mould.

By the term "cool-setting elastomeric cellular material", we mean an elastomeric cellular material which can be injected in a fluid form and which sets to a solid cellular material at room temperature or at a moderate elevated temperature, for example 120°C, which is less than the melting point of PVC.

The elastomeric strip material is a cellular rubber or plastics material and the injected

elastomeric material comprises a material which foams in situ and sets at room temperature, for example, a polyurethane.

Normally the method would be used to form a corner between two separate pieces of elastomeric cellular strip material and one end of each of the two pieces would be located in the mould with the two ends adjacent each other and the injected elastomeric material would be injected in an amount sufficient, when set, to form a join between the two ends.

On being injected into the mould, the polyurethane liquid foams and a skin forms against the surface of the mould and the foam material blends with the two ends of the lengths of the cellular elastomeric material. The foaming action generates a pressure which is not sufficient to deform the elastomeric strip material but is sufficient to fill the gap between the cut faces of the two ends and the resultant joint is substantially stress free. The polyurethane foam adheres to the unprepared surfaces of the two lengths of material as well as the cut ends thereof and hence produces a very strong corner, at the same time joining the two lengths together.

Adjustment of the amount of foaming agent controls the subsequent porosity and hence the load/deflection characteristic of the corner. Obviously, escape of the foaming material is prevented by the walls of the mould.

If the two lengths of material are hollow, it is necessary to fit a plug or other restriction into the two ends to be located in the mould, or to use external clamps.

Also according to the present invention, we provide an elastomeric cellular strip having one or more corners therein formed by a method as described above.

Although the invention can be used for forming seals in lengths of elastomeric cellular strips of any cross section, it is particularly useful for forming corners in cellular elastomeric strips which are utilised in combination with plastics edge finisher strips and used as a combined seal and edge finisher or protector around the door opening for doors and openings in motor vehicles. Three embodiments of this version of the invention will now be described with reference to the drawings accompanying the provisional specification, wherein:—

Figure 1 shows a perspective view of a corner formed in a hollow rubber seal carried by a plastics edge finisher strip,

Figure 2 is a view similar to Figure 1 but of a different construction of corner and

Figure 3 is a view of a third embodiment of corner, seen from the opposite side from Figures 1 and 2.

Referring now to Figure 1, there is shown two lengths of cellular rubber seal material 1 and 3 carried on strips of PVC edge finisher 5 and 7 respectively. The two ends of the composite strips may be cut or mitred as shown, the cuts for the plastic edge finisher strips being as accurate as possible. The actual cutting of the cellular rubber material 1, 3 is carried out at the same time as the cutting of the plastics material 5, 7 and if anything, too much of the rubber material should be cut away rather than too little. The two plastics strips 5, 7 are then secured together in known manner by means of heat welding for example or the use of adhesive and the joined corner is then placed in a mould, the shape of which corresponds with the outside shape of the required corner between the combined plastics cellular rubber sections so that the ends of the composite strips opposite the corner project from the mould, but the strips at points adjacent the corner are in sealing engagement therewith.

A foamable material such as polyurethane foam is then injected into the mould and the foaming action is allowed to reach completion with the polyurethane foam 9 filling the gap between the cut ends of the sponge rubber strips 1, 3 as shown at 11. The former corner is then removed from the mould.

If desired, the PVC edge finisher strips 5 and 7 may be mitred as described above, while the rubber strips 1 and 3 are cut away adjacent the corner along lines 2 and 4 respectively normal to the length of the strips. Thereafter, the PVC strips 5 and 7 are secured together and the corner inserted into the mould. In this case, of course, sufficient polyurethane is injected to build up the whole corner between the lines 2 and 4.

In the construction shown in Figure 2, the formation of the corner bears some similarities to that described with reference to Figure 1 except that the combined cellular rubber seal/plastics edge trim or finisher strip is not cut or mitred at the corner but is a single strip which is formed, either at ambient temperature or with the application of external heat, to conform to a radiused corner as shown at 13. Surplus cellular rubber seal material which wrinkles due to the bending of the plastics material is cut away, (or, if desired, the whole of the wrinkled corner between lines 6 and 8 may be cut away) and the radiused corner is then inserted into the mould and the foamable material injected as before so as to provide a polyurethane foam corner as shown at 15.

As an alternative to the construction shown in Figure 2, a corner can be formed in which the plastics material is curved but the cellular rubber material is generally of rectangular construction. This is shown in Figure 3. The method of manufacture is

similar to that described above and it will be appreciated that by choosing moulds of the desired shape, corners can be made to suit various requirements.

It will of course be appreciated that in the case of the three specific constructions described above, which have hollow sections for the cellular rubber seal strips, it will be necessary to plug the ends of the rubber strips within the mould prior to injecting the foam material. Instead of plugging the open ends of the rubber strips it may be convenient to clamp the cellular rubber strips externally of the mould to prevent passage of the foam material along the hollow section.

The materials to make the polyurethane foam are usually thoroughly mixed together and then injected into the void between the two ends of cellular rubber when they will expand and the foam will fill the void. However, other cool-setting, foam rubbery elastomeric materials could be used.

The advantages of the present invention are that gaps between poorly mitred corners can be filled completely, the injection of the foam material can be achieved at low pressure and temperature, the whole system is flexible in that corners of different constructions can be manufactured merely by changing moulds, there is no need for curing to occur in the normal rubber sense, i.e. the injected material will set quickly at a temperature which has no effect on the other constituents of the strip, and especially on the shape of a plastics edge finisher strip of a composite door seal, and by choosing the properties of the foam material the characteristics of the corner can be accurately chosen. Furthermore, the resultant corner is extremely neat since the foam material merges almost indistinguishably with the two lengths of elastomeric rubber sealing material.

WHAT WE CLAIM IS:—

1. A method of forming a corner in a piece or between two separate pieces of elastomeric cellular strip material including locating the material which will eventually be adjacent to the corner in a mould shaped to the required contours of the corner and subsequently injecting into the mould a cool-setting elastomeric material, which expands into a cellular structure, and generates heat and pressure in an amount sufficient to build up or form the corner, allowing the injected material to set and subsequently removing the finished corner from the mould.

2. A method of forming a corner between two separate pieces of cellular rubber material including locating one end of each of the two pieces of material in a mould shaped to the required contours of the corner with the said two ends adjacent each other and subsequently injecting into the mould a cool-setting elastomeric cellular material which sets to a cellular elastomeric material, and which generates heat and pressure, allowing the injected material to set to form a join between the two ends of the material, and subsequently removing the finished corner from the mould.

3. A method as claimed in claim 1 wherein a single piece of strip material is located in the mould after bending the strip material to provide the corner and wherein any portion of the strip material which is wrinkled due to bending is cut away prior to the injecting of the foam rubbery material.

4. The method as claimed in claim 1, 2 or 3 wherein the injected material sets to form a polyurethane foam.

5. A method as claimed in claims 1, 3 or 4 wherein, if the strip or strips of the material are hollow, suitable plugs are located within the portions of the strip material extending away from the corner to prevent the injected material from passing along the interior of the strip material.

6. A method as claimed in any one of claims 1—4 wherein, if the length or lengths of the strip material are hollow, the strip material extending away from the corners is clamped externally to prevent passage of the injected material along the interior of the strip material.

7. A method of forming a corner between two separate pieces of cellular elastomeric material substantially as hereinbefore described with reference to Figure 1 of the drawings accompanying the provisional specification.

8. A method of forming a corner between two separate pieces of cellular elastomeric material substantially as hereinbefore described with reference to Figure 3 of the drawings accompanying the provisional specification.

9. A method of forming a corner in a piece of cellular elastomeric material substantially as hereinbefore described with reference to Figure 2 of the drawings accompanying the provisional specification.

10. An elastomeric cellular strip having one or more corners therein formed by a method as claimed in any one of the preceding claims.

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2 SHEETS

PRO[redacted]NAL SPECIFICATION

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Sheet 1

FIG.1

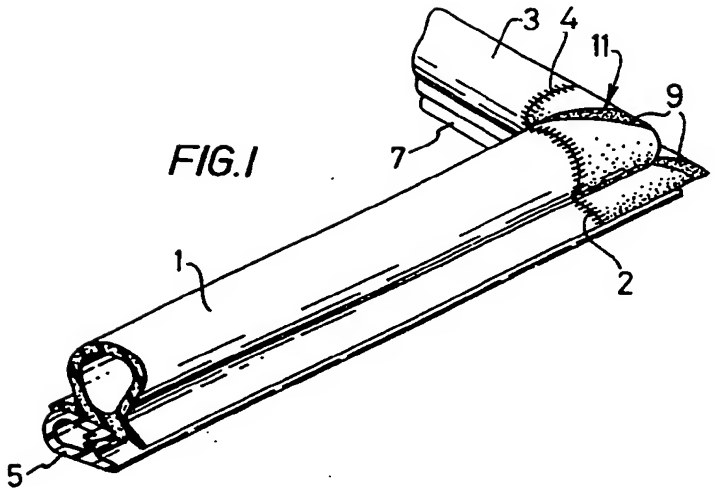
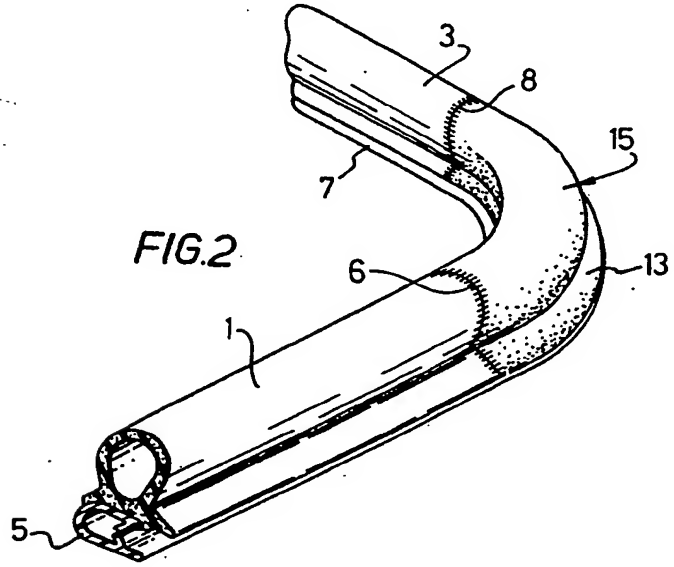


FIG.2



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2 SHEETS

PROVISIONAL SPECIFICATION

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Sheet 2

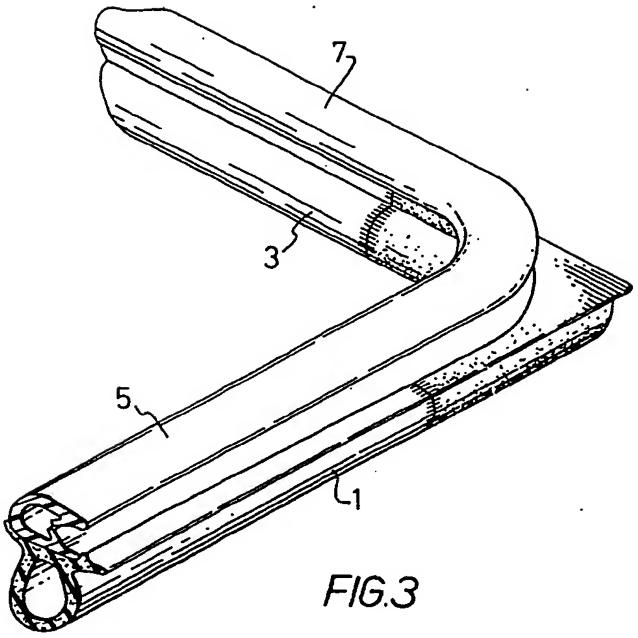

FIG.3